

wherein said hollow fiber membrane has a permselectivity; wherein a particle cutoff is within the range of 1 to 10 μm ; and wherein a pure water permeate flow is equal to or higher than 30,000 $\text{L}/\text{m}^2/\text{hr}/100\text{kPa}$.

2. (Amended) The porous hollow fiber membrane as claimed in Claim 1, wherein said particle cutoff is within the range of 2 to 5 μm and said pure water permeate flow is equal to or higher than 100,000 $\text{L}/\text{m}^2/\text{hr}/100\text{ kPa}$.

3. (Amended) The porous hollow fiber membrane as claimed in Claim 1, wherein said porous hollow fiber membrane comprises a polysulfone material.

4. (Amended) The porous hollow fiber membrane as claimed in Claim 3, wherein said porous hollow fiber membrane comprises a polysulfone material comprising 1 to 10 wt% of a hydrophilic polymer.

5. (Amended) The porous hollow fiber membrane as claimed in Claim 4, wherein the hydrophilic polymer is a polyvinylalcohol polymer.

6. (Amended) A method of making a porous hollow fiber membrane, comprising:
forming said hollow fiber membrane according to a dry-wet spinning method or a wet spinning method while using the following components:

- a spinning dope containing a base polymer as a material for forming said porous hollow fiber membrane,
- an additive for facilitating a phase separation of said spinning dope,
- a solvent compatible with both, said base polymer and said additive, and
- a mass of microparticles insoluble in said solvent, wherein said microparticles are uniformly dispersed in a liquid medium and have an average particle size within the range of 1 to 20 μm , and
- a coagulating liquid for forming the hollow fiber membrane,

to obtain a spun hollow fiber membrane; and
extracting and removing said microparticles by immersing said spun hollow fiber membrane into an extracting solution effective to dissolve said microparticles, but ineffective to dissolve said base polymer.

7. (Amended) The method of making the porous hollow fiber membrane as claimed in Claim 6, wherein the spinning dope is used in the form of a uniform spinning dope of a composition in which when only the base polymer, the additive and the solvent compatible to both the base polymer and the additive are dissolved, phase separation takes place, but addition of the microparticles suppresses the phase separation to enable spinning of the hollow fiber membrane.

8. (Amended) The method of making the porous hollow fiber membrane as claimed in Claim 6, wherein said microparticles comprise silicon oxide.

9. (Amended) The method of making the porous hollow fiber membrane as claimed in Claim 6, wherein said coagulating liquid for forming the hollow fiber membrane is a solution comprising 1 to 10 wt% of a polyvinyl alcohol.

10. (Amended) A porous hollow fiber membrane module which comprises:
a plurality of porous hollow fiber membranes as claimed in Claim 1, each of the porous hollow fiber membranes having an effective length not greater than 50 cm, each or a block of the porous hollow fiber membranes being sealed at one end thereof;

a housing;

a protective casing; and

a bonding resin block accommodated within the housing and positioned at a lower end region of the housing while an end sealing region is positioned in an upper region of the housing when the module is in use.

11. (Amended) A method of using porous the hollow fiber membrane as claimed in Claim 1 for preparing a purified water, comprising:

filtering an untreated water from a water source through said porous hollow fiber membrane.

12. (Amended) A method of using the porous hollow fiber membrane module as claimed in Claim 10 for preparing a purified water, comprising:

filtering an untreated water from a water source through said porous hollow fiber membrane module.

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13. (Amended) A method of using the porous hollow fiber membrane as claimed in Claim 1 for preparing a purified water, comprising:

coagulating an untreated water from a water source with a coagulating agent; and subsequently filtering the water through said porous hollow fiber membrane.

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14. (Amended) A method of using the porous hollow fiber membrane module as claimed in Claim 10 for preparing a purified water, comprising:

coagulating an untreated water from a water source with a coagulating agent; and subsequently filtering the water through said porous hollow fiber membrane module.

15. (Amended) A method of using the porous hollow fiber membrane as claimed in Claim 1 for preparing a purified water, comprising:

coagulating an untreated water from a water source with a coagulating agent; subsequently subjecting the water to a sedimentation or a pressurized floatation treatment to separate suspended particles from the water; and

filtering the water, from which the suspended particles have been separated, through said porous hollow fiber membrane.

16. (Amended) A method of using the porous hollow fiber membrane module as

claimed in Claim 10 for preparing a purified water, comprising:

coagulating an untreated water from a water source with a coagulating agent;
subsequently subjecting the water to a sedimentation or a pressurized floatation treatment to separate suspended particles from the water; and
filtering the water, from which the suspended particles have been separated, through said porous hollow fiber membrane module.

17. (Amended) A method of using porous hollow fiber membrane as claimed in Claim 1 for preparing a purified water, comprising:

coagulating an untreated water from a water source with a coagulating agent;
subsequently subjecting the water to a sedimentation or a pressurized floatation treatment to separate suspended particles from the water;
filtering the water, from which the suspended particles have been separated, through a sand filter, to obtain a sand-filtered water; and
filtering the sand-filtered water through the porous hollow fiber membrane.

18. (Amended) A method of using the porous hollow fiber membrane module as claimed in Claim 10 for preparing a purified water, comprising:

coagulating an untreated water from a water source with a coagulating agent;
subsequently subjecting the water to a sedimentation or a pressurized floatation treatment to separate suspended particles from the water;
filtering the water, from which the suspended particles have been separated, through a sand filter, to obtain a sand-filtered water; and
filtering the sand-filtered water through the porous hollow fiber membrane module.

19. (Amended) A method of using porous hollow fiber membrane as claimed in Claim 1 for preparing a purified water, comprising:

filtering an untreated water from a water source through a sand filter to obtain a sand-filtered water; and

subsequently filtering the sand-filtered water through the porous hollow fiber membrane.

20. (Amended) A method of using the porous hollow fiber membrane module as claimed in Claim 10 for preparing a purified water, comprising:

filtering an untreated water from a water source through a sand filter to obtain a sand-filtered water; and

subsequently filtering the sand-filtered water through the porous hollow fiber membrane module.

21. (Amended) A method of using porous hollow fiber membrane as claimed in Claim 1 for preparing a purified water, comprising:

coagulating an untreated water from a water source;

subsequently filtering the treated water through a sand filter to obtain a sand-filtered water; and

filtering the sand-filtered water through the porous hollow fiber membrane.

22. (Amended) A method of using the porous hollow fiber membrane module as claimed in Claim 10 for preparing a purified water, comprising:

coagulating an untreated water from a water source;

subsequently filtering the treated water through a sand filter to obtain a sand-filtered water; and

filtering the sand-filtered water through the porous hollow fiber membrane module.

23. (Amended) A method of using the porous hollow fiber membranes as claimed in Claim 1 for preparing a purified water, comprising:

subjecting the water to at least one treatment selected from the group consisting of ozone treatment, activated carbon treatment and chlorine treatment, either before or after the filtration through the porous hollow fiber membrane.

24. (Amended) A method of using the porous hollow fiber membrane module as claimed in Claim 10 for preparing a purified water, comprising:

subjecting the water to at least one treatment selected from the group consisting of ozone treatment, activated carbon treatment and chlorine treatment, either before or after the filtration through the porous hollow fiber membrane module.

25. (Amended) The method of using the porous hollow fiber membrane as claimed in Claim 11, wherein the purified water is prepared by backwashing separation membranes at intervals of a predetermined time using a gaseous medium.

26. (Amended) The method of using a porous hollow fiber membrane module as claimed in Claim 12, wherein the purified water is prepared by backwashing separation membranes at intervals of a predetermined time using a gaseous medium.

27. (Amended) The method of using porous hollow fiber membrane as claimed in Claim 11, wherein the purified water is prepared by backwashing separation membranes at intervals of a predetermined time using a hot water of a temperature not lower than 60 °C.

28. (Amended) The method of using a porous hollow fiber membrane module as claimed in Claim 12, wherein the purified water is prepared by backwashing separation membranes at intervals of a predetermined time using a hot water of a temperature not lower than 60 °C.

Please add the following new Claims:

29. (New) The porous hollow fiber membrane according to Claim 1 having pores in the shape of circle or ellipse.

30. (New) The porous hollow fiber membrane according to Claim 1 having a mesh structure, a honeycomb structure or a micro-interstice structure.

BASIS FOR THE AMENDMENT

Claims 1-28 have been amended to recite proper claim language. In addition, Claim 1 has been rewritten as a product-by-process claim as supported, for example, at page 7, line 17 to page 8, line 5.

New Claim 29 has been added as supported, for example, at page 11, lines 22-24 and Figures 2-4.

New Claim 30 has been added as supported at page 16, lines 4-6.

No new matter is believed to have been added by entry of this amendment. Entry and favorable reconsideration are respectfully requested.

Upon entry of this amendment Claims 1-30 will now be active in this application.

Claims 6-28 stand withdrawn from further consideration as being drawn to non-elected subject matter.

REQUEST FOR RECONSIDERATION

Applicants respectfully request reconsideration of the application, as amended, in view of the following remarks.

The present invention as set forth in amended Claim 1 relates to a porous hollow fiber membrane obtained by a method comprising

preparing a spinning dope containing microparticles;

forming said hollow fiber membrane from said spinning dope according to a dry-wet spinning method or a wet spinning method to obtain a spun hollow fiber membrane; and

extracting and removing said microparticles by immersing said spun hollow fiber membrane into an extracting solution;

wherein said hollow fiber membrane has a permselectivity; wherein a particle cutoff is within the range of 1 to 10 μm ; and wherein a pure water permeate flow is equal to or higher than 30,000 L/m²/hr/100kPa.

In contrast, Kamo et al fail to disclose or suggest a porous hollow fiber membrane as claimed, because the membrane of the reference is obtained by a different process. As a result, the product of the present invention is different from Kamo et al because the pores in the claimed membrane obtained by the claimed process are in the shape of a circle or ellipse while those of Kamo et al are slit-like pores.

In Kamo et al, as recited in method claim 8, a mixed composition consisting of polymer and fine particles is subjected to melt-spinning and subsequently, to stretching thereby causing, as mentioned in column 10, lines 10-27, a separation at an interface between the polymer and each particle so as to form voids and crazes which are then transformed into slit-like micropores. In contrast, in the present invention a dry-wet spinning method or a wet spinning method is employed and subsequently, the microparticles are dissolved by the use of an extracting solution. Accordingly, pores so formed are in the shape of a circle or ellipse and different from the slit-like pores in Kamo et al. In consequence the diversity of pore diameter in the present invention tends to be small or, in other words, pore diameter distribution becomes steep about the average diameter and the number of pores having diameters much smaller than the average diameter is small compared with the pores in Kamo et al. Since the pores with smaller diameter tend to be stuffed or clogged earlier than the pores with larger diameter, the membrane of Kamo et al may lose the initial filtering characteristics early with smaller diameter pores stuffed easily. In contrast, the membrane of

the present invention with most pores having the average diameter can maintain the initial filtering characteristics longer.

In addition, Applicants have added new Claim 29 which recites that the micropores are in the shape of a circle or ellipse.

Therefore, the rejection of Claims 1-3 under 35 U.S.C. §103(a) over Kamo et al is believed to be unsustainable as the present invention is neither anticipated nor obvious and withdrawal of this rejection is respectfully requested.

In addition, the rejection of Claims 1-5 under 35 U.S.C. §103(a) over Kawata et al is respectfully traversed.

Kawata et al fail to disclose or suggest a membrane obtained by
preparing a spinning dope containing microparticles;
forming said hollow fiber membrane from said spinning dope according to a dry-wet spinning method or a wet spinning method to obtain a spun hollow fiber membrane; and
extracting and removing said microparticles by immersing said spun hollow fiber membrane into an extracting solution;
wherein said hollow fiber membrane has a permselectivity; wherein a particle cutoff is within the range of 1 to 10 μm ; and wherein a pure water permeate flow is equal to or higher than 30,000 L/m²/hr/100kPa.

Kawata et al disclose a process for manufacturing polysulfone-based hollow fiber membranes in which a dope comprising a mixture of polymers is extruded from an annular orifice. Then the dope is mixed and dissolved in a solvent. Then a liquid containing a polymer is fed to a tubular flow of the extruded dope. The resulting polysulfone-based hollow fiber is treated with a solution that is a poor solvent for the polysulfone-based polymer. The resulting membrane has an asymmetric structure with a dense on its inner

surface and a microporous, outer surface layer (Kawata et al, col. 4, lines 7-28 and col. 3, line 61-col. 4, line 6). Furthermore, the membrane of Kawata et al is disclosed to have micropores in the order of 0.05 to 1 μm in the outer surface layer and microslits of 0.001 to 0.05 μm slit-width. Since the pores with smaller diameter tend to be stuffed or clogged earlier than the pores with larger diameter, the membrane of Kawata et al may lose the initial filtering characteristics early with smaller diameter pores stuffed easily. In contrast, the membrane of the present invention with most pores having the average diameter can maintain the initial filtering characteristics longer.

Further, the method disclosed in Kawata et al does not produce a membrane having circular or elliptic micropores throughout. (See also newly added Claim 29.) In addition, the method of the present invention allows to obtain highly regular structures, see new Claim 30, which is not possible when using the method of the reference as it results in an asymmetric structure (Kawata et al, col. 3, lines 61-65).

There is simply no disclosure or suggestion in this reference of a membrane obtained from a dope containing microparticles and extracting the microparticles. In addition, there is no suggestion of the claimed permselectivity of the claimed membrane. There is no suggestion in this reference of how to change the composition of the disclosed membrane to achieve the claimed water flow while obtaining a particle cutoff of 1 to 10 μm .

Therefore, the rejection of Claims 1-5 under 35 U.S.C. §103(a) over Kawata et al is believed to be unsustainable as the present invention is neither anticipated nor obvious and withdrawal of this rejection is respectfully requested.

In addition, the rejection of Claims 1-4 under 35 U.S.C. §103(a) over Wang et al is respectfully traversed.

Wang et al fail to disclose or suggest a porous hollow fiber membrane having the

claimed water permeate flow as claimed which are obtained by the process as claimed.

Wang et al discloses a membrane which may be a hollow fiber membrane (col. 3, lines 64 and 65) and which is obtained by providing a membrane with a hydrophobic polymer and contacting the membrane with at least one polymeric wetting agent and cross-linking to the membrane at least one cationic charge-modifying agent (col. 4, lines 14-24). In another embodiment, the reference discloses membranes obtained by casting from a formulation that includes, inter alia, a sulfone polymer, a low molecular weight organic acid and a solvent (col. 4, lines 61-65). In yet another embodiment a coagulated membrane is obtained by quenching a polymer film in an aqueous bath (col. 5, lines 26-33).

There is simply no disclosure or suggestion of a membrane obtained from a dope containing microparticles and extracting the microparticles. In addition, there is no suggestion of the claimed permselectivity of the claimed membrane. There is no suggestion in this reference of how to change the composition of the disclosed membrane to achieve the claimed water flow while obtaining a particle cutoff of 1 to 10 μm .

There is no disclosure or suggestion that the method of Wang et al produces a membrane having circular or elliptic micropores. See also newly added Claim 29.

In addition, the method of the present invention allows to obtain highly regular structures, see new Claim 30, which is not possible when using the method of the reference.

Therefore, the rejection of Claims 1-4 under 35 U.S.C. §103(a) over Wang et al is believed to be unsustainable as the present invention is neither anticipated nor obvious and withdrawal of this rejection is respectfully requested.

The Office has required restriction in the present application as follows:

Group I: Claims 1-5, drawn to a hollow fiber membrane;

Group II: Claims 6-9, drawn to a process of making a hollow fiber;

Group III: Claim 10, drawn to a hollow fiber module; and

Group IV: Claims 11-28, drawn to methods of using a hollow fiber in separation.

Applicants affirm their provisional election, with traverse, of Group I, Claims 1-5.

In regard to Groups I and II, the Office has characterized the relationship between these two groups as "process of making and product made." Citing MPEP §806.05(f), the Office suggests "the membrane is not limited to the process of making, and can be made by adding a nonsolvent for forming the pores instead of the microparticles as claimed in group of claims of group II." However, there is no evidence of record to show that the claimed membrane could be made as the Office has alleged. If, in fact, the claimed membrane can be made by "by adding a nonsolvent for forming the pores instead of the microparticles", the Office has failed to show that the alleged process is materially different from the claimed process. Accordingly, Applicants respectfully submit that the Restriction Requirement is unsustainable, and it should therefore be withdrawn.

Further, the Office has characterized the inventions of Groups I and IV as related as product and process of use. The Office states that "the membrane can be used in a distinct process, e.g. separating oil from water." However, there is no evidence of record to show that the claimed membranes are useful as the Office has alleged. In addition, the Office has failed to show that its alleged use of the claimed membranes for separating oil from water is materially different from what is claimed. Accordingly, Applicants respectfully submit that the Restriction Requirement is unsustainable, and it should therefore be withdrawn.

The Office has characterized the relationship of Groups I and III as product or membrane and an apparatus or module containing the membrane. Applicants wish to point out that if the membrane of Claim 1 is allowable, then no further search will be required for the claimed membrane module as it comprises the membrane according to Claim 1. Thus, if

the Examiner finds Claim 1 allowable, she should withdraw the Restriction Requirement and also allow Claim 10.

In addition, Applicants respectfully traverse the Restriction Requirement on the grounds that no adequate reasons and/or examples have been provided to support a conclusion of patentable distinctness between the identified groups or shown that a burden exists in searching all the claims.

Moreover, the MPEP in §803 states as follows:

“If the search and examination of an entire application can be made without a serious burden, the Examiner must examine it on the merits, even though it includes claims to distinct or independent inventions.”

Applicants respectfully submit that a search of all the claims would not impose a serious burden on the Office.

Accordingly, and for the reasons presented above, Applicants submit that the Office has failed to meet the burden necessary in order to sustain the Restriction Requirement. Withdrawal of the Restriction Requirement is respectfully requested.

Finally, Applicants note that MPEP §821.04 states, "if applicant elects claims directed to the product, and a product claim is subsequently found allowable, withdrawn process claims which depend from or otherwise include all the limitations of the allowable product claim will be rejoined." Applicants respectfully submit that should the elected group be found allowable, the non-elected claims 6-9 and 11-28 should be rejoined.

Applicants respectfully request that the Examiner acknowledge that the references cited in the Information Disclosure Statement, filed in the above-identified application on March 6, 2002, have been considered. Applicants note that the Examiner has attached a copy of Form 1449 as filed March 6, 2002 to the Office Action. However, he has not initialed each reference. For the Examiner's convenience a copy of Form PTO 1449 as filed on

March 6, 2002, is attached herewith. The Examiner is respectfully requested to initial each reference.


Applicants submit that the present application is now in condition for allowance and early notice of such action is earnestly solicited.

Respectfully submitted,

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